

leaves and branches; after this cool air has settled quietly to the ground it cools still further by its own radiation and by contact with the cooling grass and leaves until fog is formed; the particles of fog then cool by their own radiation and thus the layer of cold air grows upward and the fog grows higher and higher until a little after sunrise.

Observers who look down upon such marshes and valleys from elevated stations would do well to keep a record of the depth of the accumulated layer of fog by noting the points that are still uncovered at its upper edge.

THE "GRAN CULTURA" IN PUERTO RICO.

As the term "Gran Cultura" has no single English equivalent and must, therefore, be bodily transferred from Puerto Rican usage into local English, we take pleasure in publishing the following letter explaining the meaning of the term:

LUQUILLO, PUERTO RICO, Dec. 11, 1899.

DR. GEDDINGS,
Weather Bureau, San Juan.

DEAR SIR: In reply to your question as to the generally accepted translation of the expression "Gran Cultura," I can only tell you we never have used anything here except the two words themselves. There are two or three ways of applying them, but they all work out to the same end and mean, literally, the canes planted during the autumn of one year (say 1898) for grinding early in the second season after (or say in 1900). It may have some reference also to the fact that such canes very naturally get much more cultivation than those of shorter growth. However, I can only reiterate, it is as customary for us to speak of "Gran Cultura" when speaking to others than Spanish speaking people, as it is to apply to any general English term, and I have never heard anything else down here. In comparing with other West Indian islands it might not apply, as we do not all grind at the same season.

Yours, very faithfully,

ARTHUR C. HANSARD.

SCIENTIFIC ASSISTANTS.

The following extract from pages 64-67 of the Report of the Secretary of Agriculture for the year ending June 30, 1899, illustrates the difficulty that has been experienced by every bureau and division in this great Department and in none more so than the Weather Bureau. The steps that have been taken by Secretary James Wilson to secure men having the requisite special education must commend themselves to every one, and will, we hope, stimulate the development of the land grant and agricultural colleges, and also tend to bring their best graduates on to Washington for further study and a broader field of usefulness.

The great prosperity of the country at the present time has resulted among other things in a largely increased attendance upon our universities, colleges, and other institutions of learning. When we consider that half the people of the United States are occupied in producing from the soil directly, that about three-fourths of our exports to foreign countries come from the soil, and that the \$600,000,000 balance of trade coming to the United States during the last two fiscal years has been, to a great extent, the price of farm products, it is somewhat remarkable that so very little attention is given to the education of half the people of the nation and their preparation for their future life work.

The beautiful valleys of the mountain and Pacific coast States are being injured to a considerable extent by the injudicious use of irrigating waters. The pasture lands of the public domain west of the Missouri River are being rapidly destroyed by injudicious grazing. The wheat-growing area of the country, where crops are grown continuously, are refusing to yield as they did when first brought under cultivation, and from the Dakotas to the Pacific we find systems of fallowing in operation and crops of wheat being taken once in two years, indicating the rapid destruction of the plant food in the soil.

The people cry aloud to this Department for help. We have gone repeatedly, but in vain, to the Civil Service Commission and had them advertise throughout the country for soil physicists in order that we might cooperate with the people regarding the deterioration of their soils. All the older sections of the United States have injured their

soils by injudicious management. A knowledge of plants, their life history, the diseases to which they are subject, their relations to the soil, the climate, the food necessary so their best development, is so scarce among us that plant physiologists and pathologists can not be found by advertising for them.

Animal husbandry is very little understood, and in most of the educational institutions of the country sufficient instruction is not given to make it better understood, yet, from this source we make our most profitable sales to foreign countries. The Biological Survey and other divisions have also to train the men to do their work. When the Department requires the assistance of men educated along these lines it is necessary to educate them in its own scientific divisions, under the direction of its own scientists. When it has trained such men until they become expert and stand at the head of their specialties in the United States (and in many cases in the world), then wealthy institutions take them away by offering higher salaries, interfering with the work of the Department along the lines mentioned, which is so necessary to the producers of the United States.

To meet some of these difficulties and avoid in future their frequent recurrence, I have arranged with the Civil Service Commission to make a register of the graduates of the land-grant colleges of the United States (those endowed by Congress to educate the young farmers of the country). From this registration the scientific divisions of the Department select young men who will assist the division scientists in their work, and have opportunities for post-graduate study and for better preparing themselves along the lines of applied science, whereby the producer is helped by the scholar. We pay these young men no more than we pay a laborer, and much of the work they will perform in the divisions could be performed by skilled laborers.

Slight inquiry into education along the lines of agricultural science will show that there is no university in the land where the graduate of an agricultural college who has been studying along the lines indicated can take post-graduate work. The scientific divisions of the Department of Agriculture come nearer furnishing the necessary facilities than can be found elsewhere. If two or three young men come to each of our scientific divisions and study along the lines of the application of science to production in the field, the stable and the farm factory, the Department will in a few years have a force from which it can not only fill vacancies when wealthy institutions take away trained men, but be able to supply the agricultural colleges, experiment stations, and other scientific institutions in the land with men of superior scientific attainments in these branches.

By this new departure the Department is merely arranging to meet the imperative demands of the producers of the country for help to solve the problems that are beyond their education and their means. The Congress of the United States, in providing for the endowment of agricultural colleges and experiment stations, did more for the agriculture of the country than has been done by governmental agency for the people of any nation. Congress could not endow these institutions with teachers trained in the applied sciences relating to the farm, but Congress has built up the Department of Agriculture and encouraged the development of the foremost scientists known in their several specialties. The step we have taken toward bringing the brightest students of the agricultural colleges to prosecute their studies under the supervision of scientists in this Department is one step necessary to complete the educational system.

Something no doubt remains to be done at the other end of the educational line. The education of the young farmer in the district and high schools should be such as to help him toward the agricultural college. The other educational institutions of the country have done their work well, but so abundantly that the college graduate upon leaving college is not sure of employment that will give the salary of a brakeman on the railroad. Only a very few of those who upon leaving college must earn their livelihood through their literary education are sure of incomes equal to that of a locomotive engineer. The great unexplored field for the educator is along agricultural lines. Half of the people of the United States are interested in it. The prosperity of our country as a nation among nations depends upon it.

I hope to have the approval of Congress in this effort to provide for the higher education of the graduates of the agricultural colleges by appropriations sufficiently considerate to justify the very moderate expense that will be entailed.

BAROMETRIC CORRECTIONS AND REDUCTIONS.

On January 1, 1900, the Weather Bureau will adopt several modifications of previous usages, dictated by the needs of the service and looking to the simplification of records. A knowledge of these new rules will be useful to all who use our data, and therefore we reprint the following extracts from Instructions No. 139 of December 2, 1899:

After January 1, 1900, a specific elevation above sea level will be adopted for each station, and for purposes of record

and publication all barometric observations will be correlated to this "adopted or station elevation." In case, therefore, an office is moved to new quarters and the elevation of the barometer is thereby changed, a proper correction will be applied to the barometric readings in the new location that will reduce the observed reading to the pressure appropriate to the "station elevation," notwithstanding changes and removals.

The pressure thus ascertained will be designated "station pressure."

The "station elevation" for a station in operation January 1, 1900, will be its elevation above sea level on that date. For stations closed before 1900, or subsequently established, the elevation will be, in general, the elevation above sea level of the zero point of the barometer at the date of closing or opening the respective stations.

Reduction of current observations in accordance with the foregoing plan will, therefore, be required only when changes are made in the elevations of the barometers. In all such cases, the Instrument Division of the Central Office will furnish a new copy of the barometer correction card (Form No. 1059-Met'l), in which a "removal correction," based on the change made in the elevation of the barometers will be combined with the corrections for local gravity, scale errors, etc. The "sum of corrections" thus determined, together with the "correction for temperature," will be applied to all recorded readings of barometric pressure, and the result will be regarded as the pressure of the air appropriate to the station in question.

The barograph will be adjusted and corrected to correspond with the corrected air pressure thus obtained.

The following example will elucidate the complete correction of observed barometer readings:

Observed barometer reading (attached thermometer, 76.5°)	30.287
Correction for temperature	-0.131
Sum of corrections, Form No. 1059-Met'l.	+0.032
Total correction	-0.099
Station pressure	30.188

The "total correction," as shown above, will be entered on the present edition of Form No. 1001-Met'l, in the column in which the "correction for temperature" has been recorded heretofore, and applied to the "observed" reading, deriving thereby the pressure of the air appropriate to the adopted elevation of the station, which pressure will be recorded in the adjoining column.

All pressure observations made at a station and reduced according to the foregoing plan will, therefore, be strictly comparable with each other, all being reduced to the adopted elevation. Furthermore, a change of elevation and removal of office will not, as heretofore, necessitate a new table of reductions to sea level; that is, all observations will be reduced to sea level, when required, by one and the same table of reduction; namely, that based on the adopted elevation of the station.

The following nomenclature, embracing barometric terms, will be used, as far as practicable, in the correspondence, records, and publications of the Weather Bureau:

Actual elevation.—The height of the zero points of the barometers of a station above sea level.

Station elevation.—The elevation above sea level adopted for a station as the basis to which all pressure observations at the station are correlated.

Observed reading.—The direct result of the reading of an instrument, uncorrected for any errors.

Actual pressure.—Meaning the actual pressure of the air at a barometer, as obtained from the observed reading after

applying the necessary corrections for temperature, gravity, and instrumental errors.

Station pressure.—A pressure corresponding to an "adopted or station elevation" differing slightly from the actual elevation of the barometer. When the actual elevation is the same as the station elevation, the removal correction will be zero and the actual pressure and the station pressure are then numerically equal.

Reduced pressure.—The actual or station pressure reduced to sea level, or to some other specified plane.

Correction for scale errors, capillarity, etc.—A mean difference between the readings of a given instrument and those of the standard barometer duly corrected. This quantity embraces all outstanding errors in the total length and in the subdivision of the scale; errors in the adjustment of the sight-edge to the zero line of the vernier; errors of capillarity, imperfect vacuum, etc.

Correction for temperature.—The correction depending on the temperature of the mercury and the metallic scale.

Correction for local gravity:

(a) *Latitude term.*—The correction based on the variation of the force of gravity with latitude.

(b) *Altitude term.*—The correction based on the variation of gravity with altitude above sea level.

Removal correction.—The correction necessitated by the removal of an office, and based on the difference between the actual elevation of the barometer in the new location and the adopted elevation for the station in question.

Sum of corrections.—A term embracing all the corrections that are practically constant for a given instrument and in a given location, namely: the correction for scale error, capillarity, gravity, and the removal correction. This sum is given on the certificate of corrections (Form No. 1059-Met'l) furnished for each instrument.

Total correction.—The correction for temperature, plus the "sum of corrections" as defined above.

Reduction to sea level.—The quantity which must be added to the "actual" or "station" pressure, in order to obtain the "reduced" pressure.

Reduction for elevation.—A quantity which must be added to or subtracted from the pressure at a given elevation in order to deduce therefrom the pressure appropriate to some other specified elevation.

METEOROLOGY IN THE UNIVERSITIES.

Prof. James A. Lyon of the Southwestern Presbyterian University, Clarksville, Tenn., writes:

Our college has been enabled to take a much needed step forward in expanding somewhat our scientific department, allowing me to introduce a course in meteorology. I am using the text book of W. M. Davis, which I find an excellent one in many respects. I want to supplement the text book by as much practical work and instrumental illustration as possible.

The modern methods of teaching require that instruments be available and observations be taken in order to carry out the so-called "laboratory method" of instruction. Those who keep weather records are best prepared to profit by the work of the Weather Bureau. Those who deal in accurate measurements can best appreciate the spirit that animates all who are devoted to the progress of meteorology. Even if a school has not the funds to purchase a small outfit at the present time yet it is well to teach the subject as thoroughly as is practicable. Records of the sensible changes in temperature and dryness, the rainfall, winds, weather, and clouds, and the progress of vegetation, are still as valuable as they were long ago, when instruments were comparatively rare, and will always be of the greatest importance as a means of educating one to observe accurately and reason